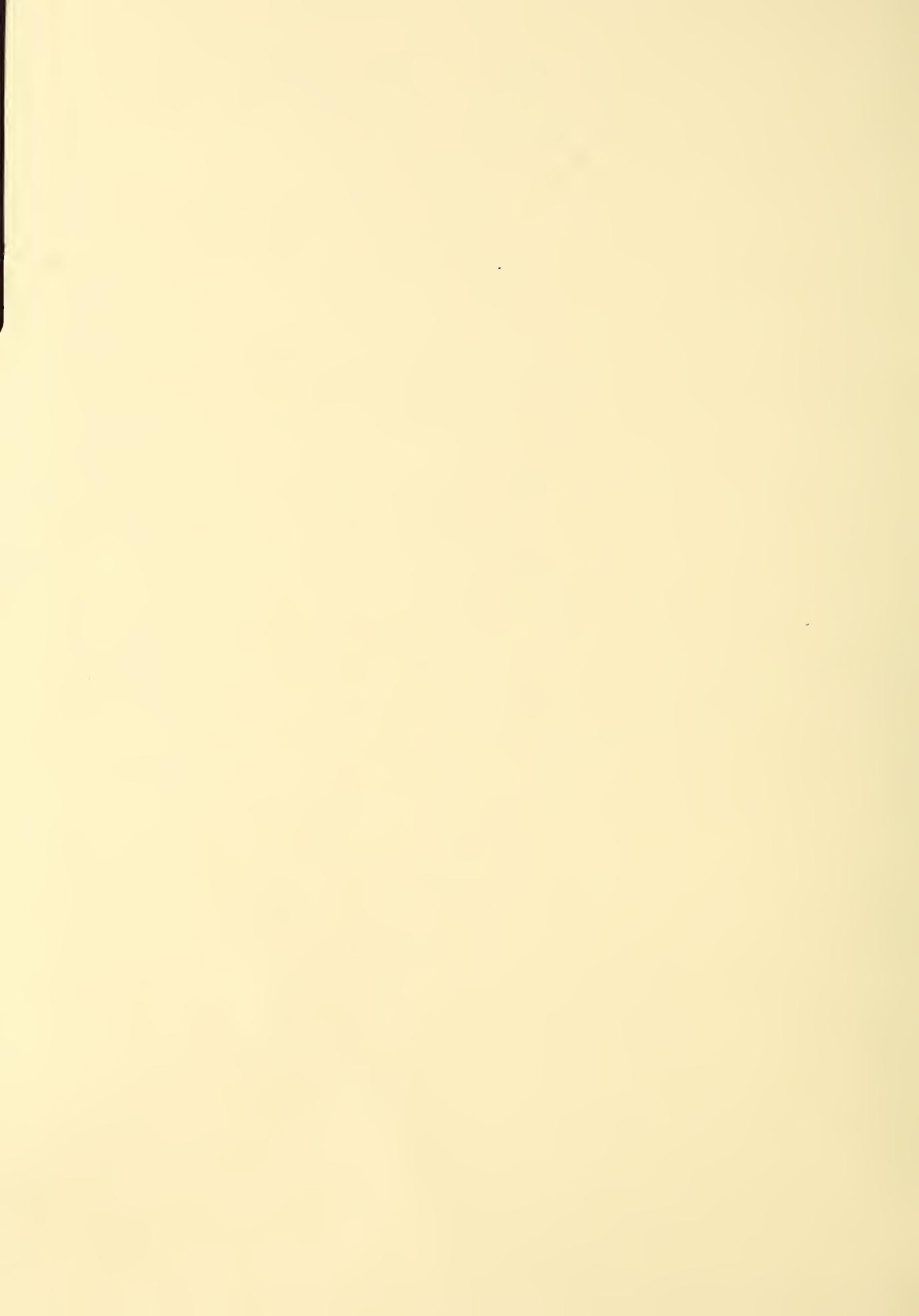


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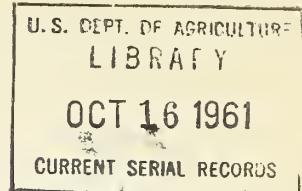
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AGRICULTURAL RESEARCH SERVICE  
Field Crops Research Branch  
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AGRICULTURAL MARKETING SERVICE

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Preliminary report not for publication<sup>1/</sup>

MILLING, BAKING, AND CHEMICAL EXPERIMENTS WITH HARD RED SPRING WHEAT  
1955 CROP 2/

by

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1/ This is a progress report of cooperative investigations containing data, the interpretation of which may be modified by additional experimentation. Publication, display, or distribution of any data or any statements herein should not be made without prior written approval of the Field Crops Research Branch, ARS, USDA, and the cooperating agency or agencies concerned.

2/ Cooperative investigations of the Field Crops Research Branch, Agricultural Research Service, and the Grain Division, Agricultural Marketing Service. The samples were obtained from the cooperative experiments with the State agricultural experiment stations in the spring wheat region.



## INTRODUCTION

Samples of the standard varieties and many of the new strains of hard red spring wheats, grown in cooperative experiments in the spring wheat region of the United States <sup>3/</sup>, are milled each year by the United States Department of Agriculture and the flours baked into bread to determine their quality characteristics.

The baking methods and techniques used on the 1955 crop were essentially the same as those used in similar work for the 1944 to the 1954 crops, inclusive, and described in previous reports.

The purpose of this report is to make available to cooperators the quality data on standard varieties, new strains, and commercial hard red spring wheat from the 1955 crop.

## SOURCE OF SAMPLES

Tests were made on composite and individual samples of the uniform varieties and of many other varieties and strains grown in plot experiments at cooperating stations. These included samples grown at Madison, Wis.; Crookston, Morris, Rosemount, and Waseca, Minn.; Newell and Brookings, S. Dak.; Langdon, N. Dak.; and Sidney and Moccasin, Mont. Similar tests were made on Eastern and Western composites of the 26 strains of wheat grown in the uniform regional nurseries; and on the wheats from the station nurseries in Wisconsin, South Dakota, and Montana. Tests were also made on a number of sawfly resistant and foreign varieties and strains of wheat grown in Montana.

There were also included 12 samples composited from samples of carlot receipts of wheat accumulated during a 90-day period of the 1955 crop movement by the Minneapolis, Duluth, and Great Falls offices of the Grain Division, Agricultural Marketing Service. These samples represent country-run receipts of the class hard red spring wheat and included only those lots that were graded No. 3 or better under the official grain standards of the United States. These hereafter are referred to as commercial samples. This is the seventeenth season that such samples have been collected and tested.

<sup>3/</sup> Ausemus, E. R. Results on spring wheat varieties grown in cooperative plot and nursery experiments in the spring wheat region in 1955. U. S. Department of Agriculture, Field Crops Research Branch 385 CC, 52 pp. University Farm, St. Paul 1, Minn. (Processed).

## METHODS USED IN MILLING AND BAKING TESTS

After the removal of dockage, the samples were prepared for milling by use of a milling separator and a scourer (both of experimental or laboratory size). The wheat samples were tempered in two stages. The water for the first temper was added 72 hours prior to milling and the moisture content of the grain was raised to between 13.0 and 16.0 percent, depending upon the hardness of the variety, or within 1 percent of the total moisture required. The additional 1 percent of water for the second temper was added 1/2 hour before milling and the moisture content of the grain was raised to between 14.0 and 17.0 percent. The wheat was milled on a Buhler automatic laboratory flour mill provided with 3 break and 3 reduction rolls. Ten percent of the low grade flour was discarded, leaving a 90 percent patent flour which was used for the chemical and bread-baking tests. However, the flour yield data in the tables are reported on the basis of a straight grade flour (100 percent) obtained from each sample.

The test weight per bushel of each sample was determined in the laboratory on the dockage-free wheat. The protein and ash contents are reported on a 14.0-percent-moisture basis and the flour yield on a moisture-free basis.

The hardness of the grain was determined by pearling 20 grams of dockage-free whole wheat for 1 minute in a model No. 38 Strong-Scott pearly. The amount of material pearlyed off, expressed as a percentage of the wheat, is called the pearly index. This index has been found useful, not only as a guide in tempering the samples for milling, but also as a measure of the hardness of the grain. A low index figure indicates hard grain and a high index figure indicates soft grain.

The bread-baking tests on the 1955 samples were made by a rich formula with none or varying amounts of potassium bromate added.

This method with the various ingredients used in 1955 is shown in table 1.

Table 1. Baking method and ingredients used for samples of the 1955 crop.

Ingredients and treatment	Weight of ingredients, etc.
Flour (grams)	100.0
Yeast (grams)	2.0
Salt (grams)	1.5
Sugar (grams)	5.0
Potassium bromate 1/ (milligrams)	Optimum
Malted wheat flour (grams)	.25
Nonfat dry milk (grams)	4.0
Shortening (grams)	3.0
Water absorption (percent)	Optimum
Mixing time (minutes)	Optimum
Fermentation time (minutes)	180
Handling of dough	1st punch after 105 minutes 2nd punch after additional 50 minutes Mold after additional 25 minutes Proofing time - 55 minutes Baked 25 minutes at 450° F.

1/ Zero to 3 mgs. of potassium bromate used as necessary to obtain maximum loaf volume.

This baking procedure is based on the method of the American Association of Cereal Chemists with certain modifications deemed necessary for unbleached, experimentally milled flour.

A check or standard flour (12.5 percent protein and 0.50 percent ash on a 14.0-percent-moisture basis) was included in the baking trials with each day's tests. The average loaf volume of the baking tests made with the standard flour was 795 cc. and the standard error was 25.8 cc. On this basis the least significant difference between 2 single bakes is 73 cc.

The undesirable properties of each variety with respect to loaf volume, crumb grain, and color characteristics of the bread are indicated in the tables by "q" for questionable and "u" for unsatisfactory, adjacent to the numerical data pertaining to the property in question. No letter or other symbol with the numerical score is used to indicate a satisfactory rating. The following scores may be used as an index for judging the crumb grain and color and the quality of the bread:

59 or below	Very poor or unsatisfactory
60 to 69	Poor or questionable
70 to 79	Fair
80 to 89	Good
90 to 99	Very good
100 and above	Excellent

Bread loaf volume must also be adequate for the protein content of the flour if the variety is to be considered satisfactory. The loaf volumes are shown in the tables on an "as is" protein basis and, in addition, they are shown adjusted to a 12.0 percent flour protein content.

An unsatisfactory rating on one or more of the properties indicates that the variety or strain is generally undesirable for hard wheat milling or bread-making purposes except that a questionable rating on one or more of the quality properties may be balanced by other outstanding properties. The milling properties are discussed in the text and should be considered along with the bread-baking properties.

Data from the sedimentation test and mixogram curves are shown for part of the samples tested this season. These tests provide additional information on the quality characteristics of the strains and varieties.

The sedimentation test is intended as a rough measure of bread-baking strength. Sedimentation values depend largely on the quantity and quality of the wheat gluten. High sedimentation values are associated with high bread-baking strength.

The mixogram curves provide information on the dough-mixing properties of the flour milled from the strains and varieties. A very rapid curve rise to the peak showing a short mixing requirement and a quick decrease in curve height following the peak, denote a lack of dough stability during mixing. In general, a gradual curve rise with a slow decline in the curve after reaching the peak indicates a dough of good stability during mixing. The results of the mixogram patterns or curves have been studied and the results are reported in the tables as very strong, strong, medium, weak, and very weak.

#### EXPERIMENTAL RESULTS Station Plot Experiments

The quality data for the uniform varieties and others grown in plots are shown in table 2.

Wisconsin - Wisconsin samples were received only from Madison. All the samples milled satisfactorily and in most instances the yield of flour obtained from them was considered good. The variety Henry was the best of these in flour yield followed by Rushmore, Mida, Thatcher, and Henry x Surprisa. The best bread was from Selkirk with Henry x Surprisa, Mida, and Thatcher, nearly as good. The dough-handling properties were only fair in Henry, and Russell being slightly short and weak.

Minnesota - Samples were received from four Minnesota stations, Crookston, Rosemount, Waseca, and Morris. All the samples milled satisfactorily and in most instances the yield of flour obtained was considered good. Many of the wheats produced a yield of flour of 76.0 percent or higher. Kentana was best of these followed by Rushmore, Henry, Selkirk, and Chapingo.

Table 2. Yield, milling, baking, and chemical results for hard red spring wheats grown in replicated "plots" in 1955.

Variety or Cross	C.I. No.	Test Weight	Index Value	Pearl- ing	Protein Wheat	Flour Yield	Ash	Absorp- tion	Mix- ing Time	Sedi- men- tation Value	Optimum Baking Method			Loaf Volume Corrected to 12.0 Percent Protein		
											Lb.	Pot.	Pct.	Pot.	Bro- ast mate	Loaf Crumb
Madison, Wisconsin																
Henry	12265	57.2	35	11.4	10.8	77.3	.50	59	2.00	26	1	716	75	80	796	
Sturgeon	11703	58.8	40	12.7	11.7	70.4	.49	58	2.00	26	1	737	90	75	756	
Thatcher	10003	54.5	25	13.7	12.8	74.4	.55	60	2.25	45	1	797	85	90	747	
Mida	12008	57.4	29	13.2	12.0	75.3	.52	60	2.25	42	1	722	85	90	722	
Lee	12498	58.1	31	15.2	13.6	72.6	.53	65	2.00	49	2	813	85	85	717	
Rushmore	12273	55.8	28	13.7	12.6	75.8	.52	60	2.50	45	1	779	80	80	741	
Selkirk	13100	54.5	31	14.7	13.8	74.2	.55	63	2.25	60	2	896	100	90	779	
Russell, H-195-45	12484	56.3	31	12.4	11.1	72.3	.48	59	2.25	36	1	710	85	80	767	
H194-41, W246	12649	57.1	29	13.2	12.1	73.5	.48	58	2.25	36	1	773	85	85	767	
Henry x Surpresa, H305-2		59.7	28	13.3	11.8	74.4	.48	58	2.00	40	1	759	80	90	772	

Crookston, Minnesota <sup>a</sup>					
Thattoher	10003	54.6	30	13.5	12.7
Mida	12008	59.0	33	13.1	12.0
Selkirk	13100	57.1	36	15.3	14.6
Henry	12265	58.0	38	13.4	12.5
Rushmore	12273	57.0	38	13.5	12.4
Conley, N.D.	13157	56.6	32	15.1	14.2
R.L. 2563 x Lee, ND	3	13159	57.7	29	15.9
Lee	12488	59.2	32	15.6	14.6
Lee x Mida Sib. <sup>b</sup>					
N.S. 3880.227	13043	60.5	31	16.2	14.6
				.43	.43
				.61	.64
					2
					927
					85
					95

Table 2. Continued

Variety or Cross	C.I. No.	Test Weight	Index Value	Protein Wheat Flour	Flour Yield	Absorp- tion	Mix- ing Time	Optimum Baking Method			Loaf Volume Corrected to 12.0 Percent Protein		
								Lb.	Pot.	Pot.	Ml.	Mg.	Co.
Rossmount, Minnesota													
Thatcher	10003	58.9	26	13.5	12.7	73.1	.50	63	2.25	50	1	775	75
Mida	12008	61.0	31	13.6	12.8	75.8	.51	61	1.75	50	1	771	95
Selkirk	13100	58.0	36	14.8	13.9	76.2	.51	62	2.25	59	2	936	90
Henry	12265	59.8	40	13.9	12.6	77.9	.48	60	2.00	51	2	858	85
Rushmore	12273	60.0	33	14.7	14.0	74.8	.52	61	2.25	56	1	818	85
Conley, ND 1	13157	59.3	31	14.9	14.0	75.4	.51	63	2.00	57	1	834	100
R.L. 2563 x Lee, ND 3	13159	59.6	28	15.0	14.1	72.8	.61	63	2.00	41	2	850	80
Lee	12488	60.0	32	15.8	14.6	72.6	.51	63	2.25	57	1	822	80
Lee x Mida sib., Ns. 3880.227	13043	61.3	30	14.9	13.8	72.8	.49	64	2.25	52	2	832	85
Yequi 54	13218	58.1	49	16.1	14.7	73.6	.50	60	1.75	64	2	881	85
Chapino	13219	59.0	32	13.4	12.4	77.2	.52	60	1.75	36	3	827	90
Average		59.5	34	14.6	13.6	74.7	.51	61.8	2.05	52	2	837	86
Waseca, Minnesota													
Thatcher	10003	60.3	24	13.5	13.0	74.0	.57	61	2.00	52	2	871	90
Rushmore	12273	62.1	27	13.1	12.6	76.0	.54	60	2.25	57	1	784	80
Lee	12488	63.3	28	14.2	13.3	73.4	.55	61	2.00	54	1	791	95
Kentana	12263	62.1	32	12.3	11.6	77.3	.53	60	2.00	43	2	818	75
Conley, ND 1	13158	61.1	29	14.1	13.1	74.3	.50	62	1.75	56	2	772	85
Mida	12008	62.4	26	12.3	11.6	75.5	.51	61	1.75	49	1	698	80
Selkirk	13100	61.3	30	13.7	13.1	75.1	.54	61	2.00	53	2	871	95
R.L. 2563 x Lee, ND 3	13159	62.2	26	14.5	13.9	74.7	.67	61	2.25	45	2	838	90
Lee x Mida sib., Ns. 3880.227	13043	63.4	28	14.1	13.2	72.8	.55	62	2.00	48	2	809	90
Average		62.0	28	13.5	12.8	74.8	.55	61	1.78	51	2	806	87

Table 2. Continued

Variety or Cross	C.I. No.	Test Weight	Pearl- ing Index	Protein Value	Wheat Flour	Flour Yield	Absorp- tion	Mix- ing Time	Sedi- men- tation Value	Optimum Baking Method	Loaf Volume	Corrected to 12.0 Percent Protein	
Morris, Minnesota													
Thatcher	10003	53.8	29	14.0	13.3	72.0	.51	61	2.25	2	902	65q	
Lee	12488	57.0	34	16.0	14.9	72.8	.49	62	2.25	2	934	85	
Rushmore	12273	56.8	38	15.2	14.6	76.3	.48	60	2.25	2	931	75	
Henry	12265	55.4	39	14.3	13.3	76.9	.45	60	2.00	2	966	85	
Selkirk	13100	55.0	37	16.1	15.2	76.4	.48	61	2.00	3	1046	80	
Mida	12008	56.5	34	14.7	13.6	73.8	.47	60	2.25	1	874	95	
Lee x Mida sib., Ns. 3880, 127,	13152	58.6	32	15.7	14.7	71.0	.49	61	1.50	1	905	100	
R.L. 2563 x Lee, ND 3	13159	56.8	30	14.5	15.8	74.0	.66	62	1.75	2	854	85	
Conley, ND 1	13158	56.2	34	15.7	15.0	70.7	.48	61	2.00	1	954	90	
Average		56.2	34	15.1	14.5	73.8	.50	60.9	2.03	2	930	83	
Newell, South Dakota (irrigated)													
Lee	12488	60.5	34	15.5	14.6	71.1	.51	60	1.75	48	2	755	85
Rushmore	12273	60.2	32	15.6	14.2	72.8	.48	59	2.00	53	1	740	75
Selkirk	13100	57.3	31	15.0	14.2	76.9	.53	60	2.25	67	1	844	80
Conley, ND 1	13157	59.0	29	15.0	14.3	74.6	.52	60	2.25	66	1	830	80
R.L. 2563 x Lee, ND 3	13159	61.4	42	15.4	14.0	70.0	.50	57	0.75	20	2	720	60q
Lee x Mida sib., Ns. 3880, 227,	13043	61.1	30	15.4	14.2	73.3	.50	60	1.50	45	1	772	80
Rush. x Haynes, SD 1935	13162	60.3	31	16.5	15.4	78.0	.49	58	0.75	42	2	769	70
Triunfo x Thatcher, SD 630	12625	59.3	26	15.7	14.9	73.1	.58	60	1.50	47	1	774	80
Spinkcoota	12375	60.6	44	15.9	14.5	71.0	.47	57	1.75	44	1	822	85
Willet	13099	56.6	40	16.5	15.2	69.2	.47	58	1.00	32	2	704	70
Frontana x Thatcher, Minn. 2854	13030	58.4	37	16.1	14.5	71.0	.49	58	0.75	32	1	770	85
Average		60.4	34	15.7	14.5	72.8	.50	58.8	1.48	45	1	773	77

Variety or Cross	C.I. No.	Test Weight	Pearl- ing Index	Protein Value	Wheat Flour	Flour Yield	Absorp- tion	Mix- ing Time	Sedi- men- tation Value	Optimum Baking Method	Loaf Volume	Corrected to 12.0 Percent Protein	
Morris, Minnesota													
Thatcher	10003	53.8	29	14.0	13.3	72.0	.51	61	2.25	2	902	65q	
Lee	12488	57.0	34	16.0	14.9	72.8	.49	62	2.25	2	934	85	
Rushmore	12273	56.8	38	15.2	14.6	76.3	.48	60	2.00	2	931	75	
Henry	12265	55.4	39	14.3	13.3	76.9	.45	60	2.00	2	966	85	
Selkirk	13100	55.0	37	16.1	15.2	76.4	.48	61	2.00	3	1046	80	
Mida	12008	56.5	34	14.7	13.6	73.8	.47	60	2.25	1	874	95	
Lee x Mida sib., Ns. 3880, 127,	13152	58.6	32	15.7	14.7	71.0	.49	61	1.50	1	905	100	
R.L. 2563 x Lee, ND 3	13159	56.8	30	14.5	15.8	74.0	.66	62	1.75	2	854	85	
Conley, ND 1	13158	56.2	34	15.7	15.0	70.7	.48	61	2.00	1	954	90	
Average		56.2	34	15.1	14.5	73.8	.50	60.9	2.03	2	930	83	
Newell, South Dakota (irrigated)													
Lee	12488	60.5	34	15.5	14.6	71.1	.51	60	1.75	48	2	755	85
Rushmore	12273	60.2	32	15.6	14.2	72.8	.48	59	2.00	53	1	740	75
Selkirk	13100	57.3	31	15.0	14.2	76.9	.53	60	2.25	67	1	844	80
Conley, ND 1	13157	59.0	29	15.0	14.3	74.6	.52	60	2.25	66	1	830	80
R.L. 2563 x Lee, ND 3	13159	61.4	42	15.4	14.0	70.0	.50	57	0.75	20	2	720	60q
Lee x Mida sib., Ns. 3880, 227,	13043	61.1	30	15.4	14.2	73.3	.50	60	1.50	45	1	772	80
Rush. x Haynes, SD 1935	13162	60.3	31	16.5	15.4	78.0	.49	58	0.75	42	2	769	70
Triunfo x Thatcher, SD 630	12625	59.3	26	15.7	14.9	73.1	.58	60	1.50	47	1	774	80
Spinkcoota	12375	60.6	44	15.9	14.5	71.0	.47	57	1.75	44	1	822	85
Willet	13099	56.6	40	16.5	15.2	69.2	.47	58	1.00	32	2	704	70
Frontana x Thatcher, Minn. 2854	13030	58.4	37	16.1	14.5	71.0	.49	58	0.75	32	1	770	85
Average		60.4	34	15.7	14.5	72.8	.50	58.8	1.48	45	1	773	77

Variety or Cross	C.I. No.	Test Weight	Pearl- ing Index	Protein Value	Wheat Flour	Flour Yield	Absorp- tion	Mix- ing Time	Sedi- men- tation Value	Optimum Baking Method	Loaf Volume	Corrected to 12.0 Percent Protein	
Morris, Minnesota													
Thatcher	10003	53.8	29	14.0	13.3	72.0	.51	61	2.25	2	902	65q	
Lee	12488	57.0	34	16.0	14.9	72.8	.49	62	2.25	2	934	85	
Rushmore	12273	56.8	38	15.2	14.6	76.3	.48	60	2.00	2	931	75	
Henry	12265	55.4	39	14.3	13.3	76.9	.45	60	2.00	2	966	85	
Selkirk	13100	55.0	37	16.1	15.2	76.4	.48	61	2.00	3	1046	80	
Mida	12008	56.5	34	14.7	13.6	73.8	.47	60	2.25	1	874	95	
Lee x Mida sib., Ns. 3880, 127,	13152	58.6	32	15.7	14.7	71.0	.49	61	1.50	1	905	100	
R.L. 2563 x Lee, ND 3	13159	56.8	30	14.5	15.8	74.0	.66	62	1.75	2	854	85	
Conley, ND 1	13158	56.2	34	15.7	15.0	70.7	.48	61	2.00	1	954	90	
Average		56.2	34	15.1	14.5	73.8	.50	60.9	2.03	2	930	83	
Newell, South Dakota (irrigated)													
Lee	12488	60.5	34	15.5	14.6	71.1	.51	60	1.75	48	2	755	85
Rushmore	12273	60.2	32	15.6	14.2	72.8	.48	59	2.00	53	1	740	75
Selkirk	13100	57.3	31	15.0	14.2	76.9	.53	60	2.25	67	1	844	80
Conley, ND 1	13157	59.0	29	15.0	14.3	74.6	.52	60	2.25	66	1	830	80
R.L. 2563 x Lee, ND 3	13159	61.4	42	15.4	14.0	70.0	.50	57	0.75	20	2	720	60q
Lee x Mida sib., Ns. 3880, 227,	13043	61.1	30	15.4	14.2	73.3	.50	60	1.50	45	1	772	80
Rush. x Haynes, SD 1935	13162	60.3	31	16.5	15.4	78.0	.49	58	0.75	42	2	769	70
Triunfo x Thatcher, SD 630	12625	59.3	26	15.7	14.9	73.1	.58	60	1.50	47	1	774	80
Spinkcoota	12375	60.6	44	15.9	14.5	71.0	.47	57	1.75	44	1	822	85
Willet	13099	56.6	40	16.5	15.2	69.2	.47	58	1.00	32	2	704	70
Frontana x Thatcher, Minn. 2854	13030	58.4	37	16.1	14.5	71.0	.49	58	0.75	32	1	770	85
Average		60.4	34	15.7	14.5	72.8	.50	58.8	1.48	45	1	773	77

Table 2. Continued

Variety or Cross	C. I. No.	Test Weight	Index Value	Protein Wheat Flour	Flour Yield	Absorp- tion	Mix- ing Time	Sedi- men- tation Time	Optimum Baking Method			Loaf Volume Corrected to 12.0 Percent Protein			
									Lb.	Pot.	Pot.				
Brookings, South Dakota															
Thatcher	10003	60.7	27	14.7	13.8	74.5	.56	.62	2.50	.58	1	847	95	85	737
Mida	12008	61.5	32	14.1	13.0	77.1	.51	.62	2.00	.58	1	787	95	100	726
Cadet	12053	58.6	27	15.2	14.3	74.5	.53	.63	2.00	.68	2	849	95	95	712
Selkirk	13100	61.1	33	14.2	13.6	74.2	.53	.62	2.00	.64	2	838	90	95	739
Rival	11708	61.7	29	14.5	13.5	74.3	.61	.63	2.25	.59	1	786	70	80	699
Lee x Mida sib., Ns. 3880.227	13043	62.5	30	15.4	14.5	75.8	.58	.62	2.00	.62	2	864	90	95	715
Rushmore	12273	60.9	32	15.2	14.5	72.1	.52	.61	2.00	.62	0	848	75	90	702
Spinckoota	12375	62.5	42	16.2	15.1	72.5	.48	.61	1.75	.54	2	873	75	85	694
Lee	12488	62.9	32	15.9	15.1	72.2	.54	.61	2.00	.53	0	876	90	95	696
Rush. x Haynes, SD	1935	62.1	32	17.1	16.5	72.4	.50	.61	1.50	.68	2	926	80	90	673
Thatcher x Triunfo, SD 630	12625	63.2	36	16.0	14.9	68.9	.49	.61	1.00	.38	1	902	80	90	726
Ceres	6900	63.0	25	14.2	13.5	74.2	.51	.62	2.00	.62	1	759	80	80	675
Conley, ND 1	13158	60.3	32	15.3	14.5	74.8	.52	.62	2.00	.67	1	855	85	80	708
R.L. 2563 x Lee, ND 3	13159	61.5	26	15.3	14.5	73.5	.70	.62	2.00	.43	1	820	80	95	679
Willie	13099	60.7	35	17.1	16.2	68.4	.51	.61	1.00	.42	1	812	95	90	601
Average		61.5	31	15.4	14.5	73.3	.54	.62	1.87	.57	1	843	85	90	699
Langdon, North Dakota															
Thatcher	10003	57.6	26	15.4	14.3	74.6	.47	.59	2.00	.68	1	833	75	90	699
Selkirk	13100	58.2	33	16.2	15.8	76.6	.49	.61	1.75	.69	3	999	90	90	759
Mida	12008	60.4	30	15.1	14.4	73.9	.49	.58	2.00	.66	3	847	85	80	706
Conley, ND 1	13157	58.0	32	16.5	16.0	76.2	.45	.59	2.00	.70	3	949	85	80	712
R.L. 2563 x Lee, ND 3	13159	59.3	28	16.8	15.9	73.2	.55	.60	1.75	.64	3	930	80	80	702
Lee x Mida sib., Ns. 3880.227	13043	61.3	33	16.4	15.7	73.3	.45	.59	1.75	.68	3	915	85	80	699
Lee x Kenya 338, ND 23	59.3	39	16.4	16.0	74.3	.53	.59	1.50	.58	3	836	75	90	627	
Thatcher x Kenya Farmer, ND 33	13211	62.9	35	15.9	14.8	74.0	.42	.58	1.25	.58	3	926	75	90	751
Lee	12488	61.6	32	16.1	15.7	73.0	.45	.58	2.00	.65	3	940	85	95	718
Rushmore	12473	59.5	29	15.1	14.8	76.1	.50	.58	2.25	.69	1	887	70	85	719
Average		59.8	32	16.0	15.3	74.5	.48	.58	1.83	.66	3	906	81	86	710

Table 2. Continued

The ash content of the flour from ND 3 (R.L.2563 x Lee) was extremely high at all the stations, indicative possibly of an inherent property.

The dough-handling properties of Chapingo (Rosemount) were sticky and weak and considered unsatisfactory. The other samples were satisfactory.

Most of the Minnesota station samples made reasonably good bread with not a very great range between the varieties in quality. The best bread appears to be from Selkirk, Thatcher, Lee, Yaqui 54, Mida, and Conley. It is interesting that ND 3 and Lee x Mida sib. have produced reasonably good bread except possibly for loaf volume. There are indications that these wheats do not produce the loaf volume expected according to their protein contents. This would mean that the quality of the gluten is not as satisfactory as that found in some of the approved hard red spring varieties.

South Dakota - South Dakota samples were received from Newell (rod-row irrigated trials) and Brookings. The Newell samples were high in protein, with none of them testing lower than 14.0 percent protein in the flour. The best samples for bread, considering the data as a whole, were Selkirk, Conley and Lee x Mida sib. Ns 3880.227. Those next best and nearly as good were Lee and Rushmore. The yield of flour from Selkirk, which was 76.9 percent, was good considering the medium low (57.3) test weight of the sample. Triunfo x Thatcher made fairly good bread. It has not been a promising strain in past years' tests.

The other samples from Newell, South Dakota, were of questionable quality for bread for the reasons as follows: ND 3, for short dough-mixing time, poor internal bread characteristics, and questionable milling properties; Rushmore x Haynes, short dough-mixing time and unsatisfactory dough-handling properties; Spinkcota, questionable dough and milling properties; Willet, generally poor or unsatisfactory characteristics in the principal quality properties and Frontana x Thatcher for short dough-mixing time and poor dough-handling properties.

Spinkcota, Willet, ND 3, and Frontana x Thatcher had high pearling index values indicative of generally a softer type wheat than the approved hard red spring varieties.

At Brookings, Willet was lower in flour yield than expected for the test weight per bushel of the sample and the dough-mixing time very short. The dough-mixing time of Thatcher x Triunfo (SD 630) was also unsatisfactory, being very short. A short mixing time is generally associated with a short mixing tolerance, definitely objectionable to the commercial baker.

The rest of the samples milled satisfactorily and produced about the amount of flour expected according to their test weights. The dough-handling properties were generally good. The best bread appears to have been made from Mida, Cadet, Selkirk, Lee x Mida sib. (Ns 3880.227) and Lee. These samples had the best bread crumb color and grain and texture.

North Dakota - Samples were received only from Langdon. The samples were high in protein content, milled satisfactorily, and in most instances the yield of flour obtained from them was good. The strain Ns 4021 x Kenya 338 (ND 23) had a high pearling index value, indicative of generally a softer type wheat than the approved hard red spring varieties. This strain produced a soft and fluffy flour to the touch.

The majority of the samples required high amounts of the oxidizing agent (potassium bromate) for the best bread results. The dough-mixing time for Thatcher x Kenya Farmer, (ND 33, and ND 23) was short. These wheats will perhaps not be commercially acceptable if this proves to be an inherent characteristic.

The samples R.L. 2563 x Lee, Conley, and Lee x Mida sib. (Ns 3880.227) have made satisfactory bread in these tests and appear to be generally similar in quality.

Montana - Samples were received from two Montana stations, Moccasin and Sidney.

Selkirk and Mida were best of the Sidney uniform varieties. The two other wheats were nearly as good, being degraded slightly because of yield of flour in Lee and internal bread characteristics in Thatcher. All the Montana samples, however, have made satisfactory bread.

The Moccasin varieties were perhaps the highest in protein content of the samples tested in 1955. None were lower in wheat protein content than 16.2 percent. Mida and Lee made the best bread considering the data as a whole. All produced bread having very satisfactory grain. In crumb color Selkirk and Thatcher were lowest.

#### Uniform Regional Nursery

Twenty-six wheats from the uniform regional nursery have been tested in duplicate for their milling, baking, and chemical properties. These consisted of an eastern composite of grain from 8 stations and a western composite of grain from 4 stations.

The results of the quality tests for the eastern and western composites and the average of both are shown in table 3. The discussion which follows is based principally on the average of the eastern and western composites.

Table 3. Milling, baking, and chemical results on 26 wheats grown in the Uniform Regional Nursery for the Eastern Composite, Western Composite, and the averages of the Eastern and Western Composites in 1955.

Eastern Composite/

Variety or Cross	C.I. No.	Test Index	Pearl- ing Lb.	Pot.	Pct.	Protein Wheat Flour	Flour Yield Affin	Ab- sorp- tion	Optimum Baking Method	Loaf Volume		Corrected to 12.0 Percent Protein	Moxogram Pattern		
										Mix- ing Time	Men- tation Bro- mated Value	Loaf Volume	Color	Grain	Score
Marquis	3641	56.7	27	14.2	13.4	73.5	.55	.58	2.00	.56	1	847	80	90	759
Thatcher	10003	55.0	26	14.5	13.8	74.4	.58	.60	1.75	.60	1	906	85	90	788
Selkirk	13100	56.4	34	15.2	14.7	76.2	.56	.62	2.25	.64	3	929	80	90	758
Lee	12488	59.4	31	15.6	14.6	72.4	.54	.62	2.25	.61	0	798	85	90	656
Conley	13157	56.2	30	15.5	14.6	74.8	.50	.62	2.25	.62	2	903	75	85	742
R.J. 2563 x Lee, ND 3	13159	57.7	27	16.2	15.3	73.1	.67	.63	2.25	.50	1	897	85	85	703
Thatcher x Kenya Farmer	13204	56.1	37	16.1	15.3	73.1	.54	.63	2.25	.69	2	966	85	90	758
Rushmore x Kenya Farmer	13205	58.6	35	15.3	14.4	73.8	.53	.62	2.25	.67	1	918	75	80	765
Ditto	13206	60.4	32	15.9	14.8	73.5	.51	.60	2.25	.67	3	825	85	95	669
Ditto	13207	58.2	31	15.0	14.0	75.6	.50	.60	2.25	.70	2	843	85	80	723
Ditto	13208	61.2	37	15.7	14.3	70.3	.56	.61	2.00	.51	1	893	100	90	749
Ditto	13209	60.8	46	15.4	14.2	73.8	.50	.58	2.00	.52	2	847	85	90	715
N.S. 4021 x Kenya Farm.	13210	58.1	39	16.4	15.5	73.0	.53	.60	1.50	.58	3	934	85	90	723
Thatcher x Kenya Farmer	13211	61.6	35	16.0	14.3	73.1	.45	.58	1.50	.62	2	837	80	90	702
N.N. 1953 x Lee	13242	56.4	29	13.5	12.9	74.0	.45	.58	1.50	.61	2	810	90	90	753
Lee x N.N. 1831	13243	58.0	31	15.1	14.1	74.9	.53	.60	1.75	.61	2	903	90	95	768
Frontana x K58-Newhatch	13212	59.5	42	15.0	13.8	71.6	.48	.59	1.50	.46	2	890	80	90	774
Frontana x Mida-K117A	13213	60.7	35	15.5	13.9	72.0	.62	.60	1.50	.44	2	845	85	85	729
Ditto	13214	60.0	35	16.2	15.1	70.6	.62	.57	1.50	.47	1	913	75	80	726
Ditto	13215	60.7	37	15.1	14.3	73.8	.63	.58	1.75	.44	2	858	85	90	720
Frontana x K58-Newhatch	13216	61.2	34	16.1	13.9	71.8	.49	.59	2.00	.56	2	850	80	90	734
Ditto	13241	60.5	41	14.9	13.4	71.1	.44	.59	2.00	.54	1	886	90	95	793
Ditto	13217	60.7	39	15.1	13.7	71.7	.45	.58	1.50	.44	2	877	75	85	768
Lee x Frontana	12457	60.9	39	15.4	14.3	70.4	.50	.59	1.75	.56	1	830	75	75	696
Yaqui 54	13218	56.6	30	15.1	14.3	72.6	.55	.59	1.75	.65	3	845	70	85	709
Chespingo 53	13219	53.6	26	14.2	13.3	75.2	.55	.58	1.75	.43	2	879	95	85	793
Average		58.7	34	15.3	14.2	73.1	.53	.59	1.88	.56	2	874	83	88	737

1/ Waseca, Morris, St. Paul, Crookston, Brookings, Madison, Fargo, and Langdon stations.

Table 3. Continued

Western Composite<sup>1/</sup>

Variety or Cross	C.I.	Test No.	Weight	Index Value	Wheat Protein	Flour Yield	Sedimen-	Loaf Volume	Loaf Volume											
									Lb.	Pct.	Pct.	Pct.	Absorp-	Mix-	Optimum	Baking	Corrected to			
													men-	Time	Bro-	Loaf	Crumb	12.0 Percent	Mixogram	
													Time	Value	mate	Volume	Color	Grain	Protein	Pattern
Marquis	3641	59.3	29	14.5	14.0	71.4	.49	.58	2.00	2	892	80	100	764	Very strong					
Thatcher	10003	58.1	28	15.5	14.8	73.3	.50	.59	2.00	2	942	75	95	763	Very strong					
Selkirk	13100	56.3	31	15.2	14.5	74.1	.49	.59	2.25	2	915	70	90	757	Strong					
Leeley	12488	59.3	33	16.0	15.1	73.0	.50	.60	2.00	2	903	85	95	717	Very strong					
Conley, ND 1	13157	57.9	32	15.6	14.7	74.3	.47	.60	2.25	2	940	85	85	767	Very strong					
R.L. 2563 x Lee, ND 3	13159	58.3	27	16.2	15.2	71.6	.61	.60	2.00	2	852	75	85	672	Medium					
Thatcher x Kenya Farmer	13204	58.4	36	15.2	14.3	73.5	.47	.60	2.00	2	952	85	90	798	Very strong					
Rushmore x Ditto	13205	59.6	34	15.5	14.5	72.8	.45	.58	2.00	2	921	70	80	762	Very strong					
Ditto	13206	60.8	32	15.6	14.3	71.9	.46	.59	2.00	2	837	85	80	702	Very strong					
Ditto	13207	60.6	32	15.0	14.1	73.6	.42	.59	2.00	1	902	80	85	767	Very strong					
Ditto	13208	62.2	34	14.0	13.9	65.9	.43	.59	1.75	1	909	90	95	784	Strong					
Ditto	13209	60.9	43	16.1	14.3	74.0	.45	.57	2.00	2	903	85	80	758	Medium					
N.S. 4021 x Kenya Farm.	13210	57.8	37	16.1	15.2	71.9	.51	.57	1.50	2	893	90	85	705	Weak					
Thatcher x Kenya Farmer	13211	61.2	33	16.0	14.7	73.2	.46	.59	1.50	2	871	70	80	711	Weak					
N.N. 1953 x Lee	13242	59.4	31	14.1	13.7	72.5	.45	.59	2.00	2	877	90	90	768	Strong					
Lee x N.N. 1831	13243	59.0	31	14.7	14.0	75.1	.49	.60	1.75	1	911	85	90	780	Very strong					
Frontana x K58-Newtch	13212	60.0	41	16.3	14.8	70.7	.49	.60	1.25	3	903	95	95	732	Weak					
Frontana x Mida-Killa	13213	60.8	35	16.2	14.8	68.8	.56	.58	1.50	1	837	95	85	678	Medium					
Ditto	13214	59.8	34	16.1	15.4	71.4	.62	.60	1.50	1	817	75	75	637	Strong					
Ditto	13215	60.5	33	15.8	14.8	70.0	.54	.59	1.50	2	903	85	80	732	Strong					
Frontana x K58-Newtch.	13216	61.2	35	16.2	15.0	68.8	.49	.61	1.50	3	893	75	85	714	Very strong					
Ditto	13241	60.4	38	15.5	14.3	70.3	.48	.59	1.50	3	942	100	95	790	Very strong					
Ditto	13217	60.7	37	15.3	14.1	71.6	.45	.60	1.25	2	869	75	85	739	Weak					
Lee x Frontaa	12957	60.7	38	16.0	14.6	73.6	.48	.62	2.25	2	926	85	95	761	Very strong					
Yaqi 54	13218	58.1	29	15.5	14.5	68.6	.49	.59	2.00	3	880	80	90	728	Very strong					
Chapingo 53	13219	56.7	25	14.2	13.2	71.4	.49	.59	1.75	2	863	85	90	784	Medium					

Average

59.5 33 15.5 14.5 71.8 .49 59.2 1.81 2 894 83 88

<sup>1/</sup> Alliance, Minot, Bozeman, and Havre stations.

Table 3. Continued

## Average of the Eastern and Western Composites

Variety or Cross	C.I.	Test No.	Weight	Pearl-ing				Absorp-tion				Optimum Baking Method				Co.
				Lb.	Pct.	Index	Protein	Flour Yield	Ash	Bro-mate	Loaf Volume	Crumbs	Color	Grain	Score	
Marquis Thatcher	3641	58.0	28	14.4	13.7	72.5	.52	58	2.00	2	870	80	95	93	762	
Selkirk	10003	56.6	27	15.0	14.3	73.9	.54	60	1.88	2	924	80	93	90	776	
Lee	13100	56.4	33	15.2	14.6	75.2	.53	61	2.25	3	922	75	90	93	758	
Conley, ND 1	12488	59.4	32	15.8	15.4	72.7	.52	61	2.13	1	851	85	93	85	687	
R.I. 2563 x Lee, ND 3	13157	57.1	31	15.6	14.7	74.6	.49	61	2.25	2	922	80	85	85	755	
Thatcher x Kenya Farmer	13204	57.3	27	16.2	15.3	72.4	.64	62	2.13	2	875	80	85	85	688	
Rushmore x Kenya Farmer	13205	59.1	37	15.7	14.8	73.3	.51	62	2.13	2	959	85	90	90	778	
Ditto	13206	60.6	35	15.4	14.5	73.3	.49	60	2.13	3	920	73	80	80	764	
Ditto	13207	59.4	32	15.8	14.6	72.7	.49	60	2.13	3	831	85	88	88	686	
Ditto	13208	61.7	36	14.9	14.1	74.6	.46	60	2.13	2	873	83	83	83	745	
Ditto	13209	60.9	45	15.8	14.3	73.9	.48	58	2.00	2	875	85	85	85	767	
N.S. 4021 x Kenya Farmer	13210	58.0	38	16.0	15.4	72.5	.52	59	1.50	3	914	88	88	88	714	
Thatcher x Kenya Farmer	13211	61.4	34	16.0	14.5	73.2	.46	59	1.50	2	854	75	85	85	707	
N.N. 1953 x Lee	13242	57.9	30	13.8	13.3	73.3	.45	59	1.75	2	844	90	90	90	761	
Lee x N.N. 1831	13243	58.5	31	14.9	14.1	75.0	.51	60	1.75	2	907	88	93	93	774	
Frontana x K58-Newthatch	13212	59.8	42	15.7	14.3	71.2	.49	60	1.38	3	897	88	93	93	753	
Frontana x Mida-K1174	13213	60.8	35	15.9	14.4	70.4	.59	59	1.50	2	841	90	85	85	704	
Ditto	13214	59.9	35	16.2	15.3	71.0	.62	59	1.50	2	865	75	78	78	682	
Ditto	13215	60.6	35	15.5	14.6	71.9	.56	59	1.63	3	881	85	85	85	726	
Frontana x K58-Newthatch	13216	61.2	35	16.0	14.5	70.3	.49	60	1.75	3	872	78	88	88	724	
Ditto	13241	60.5	40	15.2	13.9	70.7	.46	59	1.75	3	914	95	95	95	792	
Ditto	13217	60.7	38	15.2	13.9	71.7	.45	59	1.38	2	873	75	85	85	754	
Lee x Frontana	12957	60.8	39	15.7	14.5	72.0	.49	61	2.00	2	878	80	85	85	729	
Iaquil 54	13218	57.4	30	15.3	14.4	70.6	.52	59	1.88	3	863	75	90	90	719	
Chapingo 53	13219	55.2	26	14.2	13.3	73.3	.52	59	1.75	2	871				789	
Average		59.1	34	15.4	14.4	72.5	.51	60	1.85	2	885	83	88	88	740	

The small differences in quality between a number of the samples have made it extremely difficult to rank the wheats. Most all have produced bread that was satisfactory in grain with some better than others. It is of interest that 10 of the 26 varieties and strains have produced bread scoring 90 or above in crumb grain. This excellent showing in one of the important bread properties should be encouraging proof of some of the satisfactory parent material being used in the hard red spring breeding program. The milling and dough properties have been deficient in some wheats. The crumb color scores were about medium with 13 of the wheats making bread having crumb color scores of 85 or higher which is considered good.

It has been possible because of the general similarity in quality of a number of the samples to group them for the purpose of discussion.

Thatcher has appeared to be slightly the best in quality of the approved and named hard red spring wheats. Selkirk, Marquis, and Lee rank next in order. Selkirk required the highest amount of potassium bromate for optimum bread of the four varieties. In this test Lee produced a lower loaf volume than expected on the basis of the protein content of the sample. This has usually been the case in previous years.

Conley (ND 1) has made better bread, considering the data as a whole than ND 3. Both resulted from the same R.L. 2563 x Lee cross. It is of interest that Conley was also the highest of the two in protein content. The mixogram patterns for the above-named varieties were generally very strong showing satisfactory stability and dough-mixing time and tolerance. Strain ND 3 had the highest flour ash content of the 26 varieties and strains. The most promising sample among the Rushmore x Kenya Farmer strains appears to be C.I. No. 13207. The strain ranking second best was C.I. No. 13205. The other Rushmore x Kenya Farmer strains have been found deficient in one property possibly important enough to classify them as questionable. These are discussed as follows:

The very high pearling index value of C.I. No. 13209 indicates that this grain is softer than the approved hard red spring varieties and may possibly not meet with approval from the milling trade. The results were similar for the western and eastern composite nursery samples. The loaf volume of C.I. No. 13206 was low considering the protein content of the sample. The milling properties were only fair in sample C.I. No. 13208 and the yield of flour low. All of these wheats, however, produced bread satisfactory in internal characteristics. It is of interest that the dough-mixing times for these strains were satisfactory and similar to the approved hard red spring varieties.

The three Kenya Farmer strains, two crossed with Thatcher and one with Ns 4021, have made satisfactory bread. The two strains, Nos. C.I. 13210 and 13211 have, however, dough-mixing times that are about 25 percent shorter than the accepted varieties. This is perhaps not too serious. Strains NN 1953 x Lee and Lee x NN 1831 were strong wheats and have made good quality bread. Strain NN 1953 x Lee had a slightly short dough-mixing time. The mixogram patterns for C.I. Nos. 13210 and 13211 were not as strong as the approved hard red spring varieties.

The strains in which the variety Frontana has been used as one parent have in general shown a deficiency in milling quality. These were C.I. Nos. 13212, 13, 14, 16, 17, and 41. Six of the eight wheats were rated as poor or fair. In general, the flour was found soft to the touch, bolted or sieved slowly, and the bran difficult to clean free from flour. These strains are generally softer in kernel structure than the approved hard red spring varieties. The pearling index values of these strains averaged in general higher than the comparably grown samples of Marquis and Thatcher. The yield of flour is not as high for the strains, considered on a test weight per bushel basis, as compared with the results from Marquis, Thatcher, or Selkirk. The flour ash contents of the three Frontana x Mida-K117A strains were all high, suggestive of an inherent characteristic. The two Frontana strains (C.I. Nos. 13212 and 13213) produced weaker mixogram patterns than the accepted hard red spring varieties. The Frontana strains making the best bread, considering the data as a whole, were C.I. Nos. 13215 and 12957.

Chapingo 53 appears to have made slightly better bread and was higher in yield of flour than Yaqui 54. The dough-handling properties of Chapingo 53 were inferior to those of Marquis or Thatcher. The mixogram pattern of Chapingo 53 was weak for the eastern composite and medium for the western composite.

Mixogram patterns or curves have been made on each of the eastern and western composite varieties and strains and the results of this test are shown in the table with the other quality data. It is evident from these data that there were some differences in the dough characteristics between a few of the varieties and strains. Thus, comparing several strains, there was a difference between the pattern characteristics for the samples in the 2 composites for the following: R.L. 2563 x Lee (ND 3), Rushmore x Kenya Farmer (C.I. 13209), NS 4021 x Kenya Farmer (C.I. 13210), Thatcher, Kenya Farmer (C.I. 13211), Frontana x K58-Newthatch (C.I. 13212 and 13217), and Frontana x Mida-K 117A (C.I. 13214), the western composite samples being generally the weaker of the 2 area composites. Strains Frontana x K 58-Newthatch (C.I. 13210) and Chapingo 53 had a tendency to be weak and/or medium in curve characteristics in both composites. The approved and named hard red spring varieties produced very strong mixogram curves indicative of their satisfactory dough properties.

#### State Nursery Trials

Results for the samples grown in the State nursery trials are shown in table 4. These included samples from Madison, Wisconsin and the advanced nursery trials at Brookings, South Dakota. Similar tests were made on composites of a number of varieties and strains grown in rod-rows at Highmore, Eureka, and Cottonwood, South Dakota; Moccasin, Havre, and Sidney, Montana, and from the advanced yield nursery at Havre, Huntley, and Sidney, Montana.



Table 4. Continued

Variety or Cross	C.I. No.	Test Weight	Pearl- ing Index	Protein Value	Wheat Flour	Flour Yield	Ash	Ab- sorp- tion	Mix- ing Time	Optimum Baking Method	Loaf Volume	Corrected to 12.0 Percent Protein	
South Dakota Rod-Row Nursery Composite <sup>1/</sup>													
Rushmore	12273	57.0	30	16.2	15.3	72.7	.53	.61	2.50	60	2	1013	85
Mida	12008	58.7	28	15.5	14.8	73.0	.55	.61	2.25	59	2	947	95
Lee	12488	57.0	30	16.9	15.8	72.2	.57	.61	2.25	63	2	936	85
Selkirk	13100	53.9	30	16.2	15.6	73.9	.57	.65	2.00	64	2	985	95
Willet	13099	57.0	34	18.0	16.8	68.1	.49	.59	1.50	45	3	963	80
Thatcher	10003	56.0	28	17.3	16.3	69.1	.56	.60	2.25	63	1	1000	75
Cadet	12053	56.3	27	16.6	16.0	71.0	.58	.66	2.25	66	2	996	90
Rival	11708	57.6	27	15.7	14.8	72.1	.63	.63	2.00	60	2	893	80
Pilot	11945	57.1	26	15.9	15.0	69.0	.55	.61	2.00	64	1	945	80
Ceres	6900	58.4	25	16.2	15.2	70.6	.54	.62	1.75	65	2	901	85
Frontana x II-44-22	13202	58.2	43	17.3	16.2	71.5	.55	.59	1.75	43	2	929	60q
Frontana x II-44-29	13156	58.2	33	16.9	15.7	67.3	.48	.62	2.00	59	2	991	80
Rush. x Haynes Bluestem, SD 1931	13049	59.7	27	17.4	16.7	72.3	.65	.65	1.25	47	2	940	75
Ditto, SD 1935	13162	58.0	31	17.2	16.7	74.3	.56	.62	1.50	69	3	1009	80
Thatcher x Triunfo, SD 63012625	59.1	35	17.1	16.0	69.0	.51	.64	2.00	64	2	1034	85	
Conley, ND 1	13157	56.0	34	16.4	15.9	72.3	.51	.64	2.00	64	2	1047	90
R.L. 2563 x Lee, ND 2	13158	56.3	29	17.8	16.8	69.5	.71	.62	1.50	40	2	905	85
R.L. 2563 x Lee, ND 3	13159	56.8	28	17.3	16.4	72.3	.70	.65	1.75	37	2	896	90
Lee x Mida sib., Ns.	13152	57.5	25	17.1	15.9	72.7	.58	.64	1.50	52	3	892	95
Lee x Mida sib., Ns.	13043	58.4	33	17.0	15.8	73.2	.54	.64	1.75	56	2	937	100
Average		57.4	30	16.8	15.9	71.3	.57	.62	1.86	56	2	958	85
												92	725

<sup>1/</sup> Composite of Highmore, Eureka, and Cottonwood stations.

Table 4. Continued

Variety or Cross	C.I. No.	Test Weight	Pearl- ing Index	Protein Value	Wheat Flour	Flour Yield	Ash	Ab- sorp- tion Time	Mix- ing Time	Sedi- men- tation Value	Optimum Baking Method			Loaf Volume Corrected to 12.0 Percent Protein
											Pot.	Pot.	Pot.	
Montana Single Row Yield Nursery Composite/ 1/														
Thatcher x Lee, B55-16	60.0	34	15.7	14.8	70.2	.52	59	1.50		2	833	85	90	675
Ditto	60.2	33	16.1	15.3	75.5	.57	60	2.00		2	839	85	95	658
"	59.4	35	15.9	15.4	74.0	.59	61	1.50		2	820	80	80	639
"	60.0	30	15.9	14.9	69.8	.52	59	2.00		2	849	90	80	684
"	61.6	33	15.6	14.8	72.2	.51	59	1.50		2	859	80	90	696
B55-13	59.6	31	15.5	14.5	70.1	.53	60	1.50		1	829	95	90	686
B55-2	60.3	35	15.6	14.6	70.2	.47	59	1.50		3	925	85	90	760
B55-19	59.3	31	15.0	13.9	71.2	.47	58	1.50		1	810	100	90	648
B55-1	58.9	36	15.1	14.1	72.4	.42	57	2.00		1	852	85	95	677
B55-11	60.7	35	16.0	14.1	68.9	.48	58	1.50		2	877	85	90	727
B55-17	59.4	34	15.9	14.8	71.0	.45	59	1.50		2	838	85	85	679
B55-15	58.7	39	15.6	14.1	77.3	.46	58	1.75		1	866	100	85	737
B55-9	59.8	39	15.0	14.2	73.1	.42	57	2.00		1	899	85	95	760
B55-4	60.6	35	16.2	14.7	70.7	.44	59	1.50		2	850	90	90	694
Lee	12488													
Thatcher x Lee, B55-8	59.5	35	15.5	14.6	74.2	.46	58	2.00		1	910	95	95	748
Selkirk	57.1	35	15.5	14.2	73.4	.43	59	1.75		2	893	85	90	755
Thatcher x Lee, B55-21	60.4	34	15.7	13.7	72.2	.43	60	1.50		1	855	90	95	749
Ditto	61.6	33	15.4	14.2	72.1	.42	60	1.50		1	873	85	90	738
"	60.2	31	16.2	14.3	68.2	.46	59	1.50		2	889	95	85	746
B55-18	60.1	34	15.8	14.0	69.6	.40	58	1.50		2	881	85	90	755
B55-20	58.3	32	16.0	15.2	75.5	.57	60	1.50		2	823	75	75	650
B55-3	59.7	38	15.7	14.6	71.6	.45	57	1.75		2	890	80	90	732
B55-10	59.5	39	15.5	14.5	74.3	.42	57	2.00		2	807	75	85	668
B55-5	10003	59.8	38	14.8	74.0	.43	60	2.00		1	887	85	85	760
Thatcher														
Average		59.8	35	15.6	14.5	72.2	.47	58.8	1.68	2	861	87	89	709

1/ Composite of Moccasin, Havre, and Sidney stations.

Table 4. Continued

Variety or Cross	C.I. No.	Test Weight	Pearl-ing Index	Protein Value	Wheat Flour Yield	Flour Absorp-tion Time	Mix-ing Time	Optimum Baking Method	Loaf Volume							
									Lb.	Pot.	Pct.	Min.	Mg.	Co.	Score	Score
Montana Advanced Yield Nursery, 1955 crop/ /																
1520 x 1752, N2389	13041	61.9	29	14.7	13.4	73.8	.44	61	1.75	.57	1	855	70	90	766	
Pilot 2 x Thatcher, N2170	12974	60.1	29	15.2	13.8	71.6	.43	58	2.00	.64	1	908	85	90	790	
Lee x 1831, B52-63	60.5	31	15.8	14.2	70.9	.44	61	1.50	.54	1	833	85	85	845		
Marquis	3641	59.7	30	15.2	14.1	72.3	.51	60	1.50	.58	1	897	85	90	763	
Chinook, H-4258	13220	60.5	31	15.5	14.5	73.1	.45	60	1.50	.62	1	840	85	95	695	
Rescue x Thatcher, S-615.	B51-16	61.4	30	14.5	13.7	71.7	.50	61	2.00	.61	0	813	80	85	712	
Selkirk (Bozeman)	13100	55.5	32	15.2	14.4	73.4	.48	62	2.00	.69	1	855	85	85	713	
Lee x 1831, B52-120	60.5	28	14.6	13.4	73.7	.47	60	1.75	.48	2	830	90	95	743		
Lee	12488	59.6	32	15.8	14.6	71.6	.47	60	1.75	.55	2	797	95	90	655	
Pilot 2 x Merit, N2164	59.2	22	15.0	13.8	70.9	.54	61	2.25	.61	1	875	85	95	761		
1750 x 1753, N2256	12975	60.6	24	14.4	13.3	72.9	.54	61	2.25	.54	1	817	70	90	737	
Ceres	6900	60.1	25	14.6	13.6	71.8	.51	58	1.75	.63	1	776	65q	80	685	
Rescue	12435	58.7	32	14.5	13.9	74.0	.49	58	2.00	.66	1	880	80	95	760	
Lee x 1831, B52-119	13243	58.9	30	14.6	13.4	74.9	.49	59	1.50	.57	3	845	95	95	757	
1953 x Lee, B52-94	58.7	32	15.1	14.1	73.6	.46	59	2.25	.64	2	845	75	90	719		
Pilot	11945	58.3	26	14.6	13.4	71.6	.47	58	1.75	.63	2	887	80	85	794	
Mida	12008	60.6	31	15.5	14.4	74.6	.47	61	1.75	.59	1	865	80	95	721	
1764 x Rescue, B49-78	59.6	26	14.6	13.7	72.3	.50	60	2.00	.65	2	843	75	90	738		
Rescue x Thatcher, B50-18	13244	61.1	31	14.6	13.7	73.4	.46	58	1.75	.65	1	874	90	95	766	
1953 x Lee, B52-91	13242	58.7	33	14.4	13.2	73.0	.42	60	1.50	.66	1	847	85	85	770	
Pilot 2 x Regent N2183	13042	58.6	29	14.9	13.6	71.1	.44	58	2.00	.66	2	891	85	95	786	
1953 x Lee, B52-92	58.5	33	14.6	13.6	74.3	.45	58	1.75	.66	2	866	95	95	764		
Rescue x Thatcher, S615, B51-43	60.3	30	14.9	14.0	72.3	.46	59	1.75	.65	2	835	80	85	716		
Selkirk (Sidney)	13100	56.5	32	15.3	14.5	74.4	.48	62	2.00	.68	2	911	85	85	753	
2236 x Lee, B52-107	57.6	31	15.4	14.4	72.0	.49	63	1.75	.61	2	909	85	90	758		
Rescue x 1831, B51-9	60.1	29	14.9	14.0	74.6	.49	58	1.75	.65	2	899	90	80	771		
Supreme	8026	56.6	28	14.6	13.4	68.8	.50	58	2.25	.64	2	822	85	85	736	
Thatcher	10003	59.0	30	15.2	14.5	73.8	.58	60	2.00	.63	2	881	95	90	729	
1953 x Lee, B52-90	60.6	30	16.2	14.9	71.4	.56	62	1.50	.63	1	838	90	90	675		
1898 x Lee, B52-57	58.9	27	15.3	15.3	73.8	.57	59	2.00	.68	1	868	100	95	681		

Average

59.4 29 15.0 14.0 72.7 .49 59.8 1.84 62 2 857 84 90 742

1/ Composite of Havre, Huntley, and Sidney, Montana stations.

Madison, Wisconsin

All the nursery samples were high in protein content and milled satisfactorily with Henry producing the highest yield of flour. The best bread was made from Lee, Henry, and H441B-15-2-2-3 and 4. The doughs of all were strong and elastic.

The three Frontana x H195-13-7 strains made poor bread. The dough-handling properties of these were poor, being short and sticky and the dough-mixing time shorter than the approved hard red spring varieties. They made bread low in loaf volume and with unsatisfactory internal characteristics. These are not satisfactory bread wheats.

Kenya 184P2AIF made medium good bread but it is not considered as strong in quality as Henry.

Brookings, South Dakota Advanced Nursery

The differences in quality between a number of the samples were small, making it possible to group the wheats for the purposes of discussion. Many of the varieties and strains have produced bread that was satisfactory in grain, with some better than others. It is of interest that 19 of the 27 wheats have produced bread scoring 85 or higher in crumb grain. This is an excellent showing and encouraging proof of some of the satisfactory parent material being used or employed in the hard red spring breeding program.

The milling and dough-properties have been deficient in some samples. Certain quality properties of the varieties within a group will be discussed especially where they vary from the general average found within the group. The trade does not look with favor on a variety or strain that has as short a dough-mixing time as many of these samples. Short dough-mixing time wheats have most always been found to have also a short mixing tolerance, an unfavorable property when using high speed dough mixers common in many of today's bakeries. Dough-mixing times of about 1-1/2 minutes or less, according to our experimental laboratory practice, are considered short and will generally average from 50 to 75 percent shorter than that of the approved hard red spring varieties.

The wheats from Brookings were reasonably high in protein content and a number of the flours high in ash. The grouping of the samples for discussion will be based to a large extent on a consideration of the data as a whole.

The Brookings, South Dakota varieties and strains with short dough-mixing times have been found generally to have weak mixogram patterns and are inferior in this respect to the approved hard red spring varieties. Only a few strains from this station produced very strong mixogram curves. These wheats are generally those with the best dough characteristics.

Those wheats perhaps strongest in quality and making the best bread were RC 49108, R<sup>3</sup>S 975, R<sup>3</sup>S 905, and Yaqui 53A. These samples had satisfactory milling and dough-handling properties. The next best samples which were nearly as good as the first group were R<sup>3</sup>S 863, R<sup>3</sup>S 710, and R<sup>3</sup>S 934. The internal bread characteristics of these were not quite as good as the wheats in group one. In the third group were Mida x K117A, R<sup>2</sup>S 1092, R<sup>3</sup>S 789, and K-M-RN 3293. The dough-mixing times on these were in the questionable range, the principal factor in classifying them third. The crumb grain of these samples was, in general, excellent. Strain R S 789 would have rated best of the Brookings wheats in quality had the dough-mixing time been more satisfactory. This was one of the better strains in milling quality and produced a high yield of flour. Strain (K-M<sup>2</sup>) ME 1442 had a short dough-mixing time, but otherwise produced a medium satisfactory loaf of bread.

A number of the strains have made satisfactory loaves of bread (volume, crumb color, and grain), but were deficient in dough properties, averaging short to very short in dough-mixing time. These were R<sup>3</sup>S 785, R<sup>3</sup>S 992, R<sup>3</sup>S 739, and R<sup>3</sup>S 851.

A number of the other strains made good bread, but were deficient in both mixing time and dough-handling properties. These were R<sup>2</sup>S 1084, R<sup>3</sup>S 997, ME<sup>2</sup> x N1930-2T-9H, and ME<sup>2</sup> x N1930-3T-1H. In addition to the above deficient properties Triunfo was questionable in milling quality.

The strains listed below were deficient in one or more quality properties as follows: K.G. PK58N, most all of the important quality characteristics (note exceptionally high flour ash content); R.E. x Frontana, high flour ash, milling, and dough-handling properties; R<sup>3</sup>S 648, low loaf volume and dough properties; Lerma 52 and R<sup>3</sup>S 986, dough-mixing time, dough-handling characteristics, and medium low internal bread properties; and Mayo 54, slow bolting in the milling process.

Seven of the samples had very high pearling index values indicative of soft type wheat. These were Triunfo, Mida x K117A, Lerma 52, Mayo 54, Yaqui 53A, K-M-RN 3293, and (K-M<sup>2</sup>) ME 1442.

Highmore, Eureka, and Cottonwood, South Dakota  
Rod-Row Nursery Composite

Most of the samples milled satisfactorily although many were low (56.0 pounds or less) in test weight per bushel. The flour yields appear to be about that expected considering their test weights. None produced a very high yield of flour. Mida, Selkirk, SD 1935 and Lee x Mida sib. (3880-227) were highest of the group in flour yield.

The dough-handling properties of Rushmore x Haynes Bluestem, SD 1931, Thatcher x Triunfo (SD 630) and the two Lee x Mida sib. selections 3880.127 and 227 were unsatisfactory being weak, soft, and sticky. The dough-mixing time for SD 1931 was shorter than that of the approved hard red spring varieties. The flour ash content was particularly high for Rival, Rushmore x Haynes Bluestem (SD 1931), RL 2563 x Lee, ND 1 and ND 2; and Lee x Mida sib. (Ns 3880.127). This high ash content may be due in part to the low test weight of the grain and/or an inherent property of the strain. Low test weight grain often mills with difficulty.

Many of the South Dakota samples made reasonably good bread with not much difference between the varieties or strains in quality. The best bread appears to be from Mida, Selkirk, Cadet, Conley, RL 2563 x Lee (ND 3), and the two Lee x Mida sib. (Ns 3880.127 and 227). It will be observed that a number of the samples produced loaf volumes of 1,000 cc. or better which is reasonable in view of their high protein contents. These varieties and strains averaged high in crumb color and grain and texture. Most of the samples required a high amount of the oxidization agent potassium bromate for optimum bread results.

Moccasin, Havre, and Sidney, Montana  
Single Rod-Row Nursery Composite

The varieties and strains have been ranked numerically into groups. This ranking is based to a large extent on a consideration of the data as a whole. These wheats have made, with some exceptions, generally satisfactory bread with the difference in quality not very great between many of the samples. The small differences in quality between the samples have made it extremely difficult to rank the wheats. Most all have produced bread that was satisfactory in grain with some better than others. The milling and dough properties have been deficient in some.

In the nursery composite 16 wheats have made very satisfactory bread and were ranked first. These were Lee, Selkirk, and the 14 Lee x Thatcher strains, B55-1, 2, 4, 8, 9, 10, 11, 12, 13, 14, 15, 16, 19, and 21. These all milled satisfactorily and their dough-handling properties were good, being elastic and pliable. The yield of flour for Thatcher x Lee (B55-9) was 77.3 percent and exceptionally high for a wheat having a test weight of 58.7 pounds.

The two wheats, Thatcher and Thatcher x Lee (B55-5), were ranked second because of their slightly low internal bread score. The differences in quality between these wheats and those rated first are very small.

Thatcher x Lee (B55-7 and B55-17) ranked third in quality. These were degraded because of their somewhat low flour yields in comparison to the test weight per bushel of the samples.

Four wheats were ranked fourth in quality. These Thatcher x Lee strains were graded down for the reasons as follows: B55-6, for weak dough-handling properties; B55-18 and B55-20, for only fair milling properties since the bran was difficult to clean free of flour, and B55-3, for inferior internal bread characteristics.

It is of interest to note that a number of wheats produced flours of high ash content which may or may not be an inherent characteristic. These were Thatcher x Lee (Nos. B55-14, 6, and 3).

Havre, Huntley, and Sidney, Montana  
Advanced Yield Nursery

The varieties and strains for this Montana composite have been ranked numerically into groups which are based to a considerable extent on a consideration of the quality data as a whole. Actually none of these samples has appeared to make bread that would be considered unsatisfactory. All the wheats were relatively high in protein content with none lower than 13.3 percent in the flour.

Those samples making satisfactory bread and ranked first were Pilot<sup>2</sup> x Thatcher (N2170), Selkirk (Bozeman), Lee x 1831 (B52-120), Rescue, Rescue x Thatcher (B50-18), Pilot<sup>2</sup> x Regent (N2183), 1953 x Lee (B52-92), Rescue x Thatcher S615 (B51-43), Selkirk (Sidney), 2236 x Lee (B52-107), Rescue x 1831 (B51-9) and Thatcher. Strain 1898 x Lee (B52-57) also ranking first, was one of the highest in protein content, made bread having excellent internal characteristics, but the loaf volume corrected to 12.0 percent protein content was lower than expected. All these milled satisfactorily and their dough-handling properties were good, being elastic and pliable.

Fourteen wheats were ranked second. Six of these were Lee x 1831 (B52-63), Marquis, Rescue x Thatcher S615 (B51-16), Lee, Pilot, and Mida. Comments on others ranking second are as follows:

1520 x 1752 (N2389), 1953 x Lee (B52-94), and 1764 x Rescue (B49-78), were low in crumb color of bread. Strain 1953 x Lee (B52-90) was deficient in dough-handling properties and had a mixing time slightly shorter than Thatcher or Mida. 1750 x 1753 (N2256) was deficient in crumb color and milling quality, otherwise it made good bread.

For Lee x 1831 (B52-119), dough-mixing time was short, but the crumb color and grain of bread were very good.

The dough-handling properties of 1953 x Lee (B52-91) were inferior.

Pilot<sup>2</sup> x Merit (N2164) milling quality was fair, otherwise it produced a good loaf of bread.

These varieties and strains as a group were slightly deficient in some one property than those ranking first in quality.

Three varieties were ranked as third. A discussion of these is as follows:

The dough-handling properties of Chinook were deficient and the dough-mixing time was short.

The crumb color of Ceres was poor and lower than general for this variety.

Supreme was deficient in milling quality. It produced satisfactory bread, but was poorer than is generally expected for this variety.

#### International Sawfly Yield Nursery

The results for a number of varieties and strains resistant to wheat stem sawfly grown in the International Sawfly Yield Nursery trials at Dutton and Sidney, Montana are shown in table 5. These trials include many strains of current interest. One of the principal interests in these tests is a comparison of the quality of the strains which include Rescue in their parentage, with that of Thatcher and Rescue.

The varieties and strains have been ranked numerically into three groups. This ranking is based to a large extent on a consideration of the data as a whole. These wheats have made, with some exceptions, generally satisfactory bread with the differences in quality not very great between many of the samples. The small differences in quality between the samples in the first two groups have made it extremely difficult to rank the wheats. Most all have produced bread that was satisfactory in grain, with some better than others. The milling and dough properties have been deficient in some. The crumb color scores were about medium with a few wheats making bread having crumb color scores of 85 or higher, which is considered good. Only one wheat made bread lower in loaf volume than expected, considering the protein content of the flour. This was weaker than those samples producing loaf volumes more in accordance with that expected as based on their protein contents.

Those varieties and strains making the best bread and being strongest in quality were ranked in the first group and are as follows: Thatcher; Rescue x Thatcher (51-2622), Rescue x 1831 (51-3373 and B51-9), and 2083 x Rescue (51-2223). Those ranked in the second group were inferior in one or more of their properties than the wheats ranking higher. These are promising wheats and should be tested further before a definite decision is made with respect to their milling and baking quality. These wheats are Rescue, Rescue x Chinook (51-3625 and 51-1697), Rescue x Saunders (4015-1E2), Rescue x Thatcher (B50-18), 1764 x Rescue (B49-78), Rescue x Regent L.506 (4016-2E), Rescue x Th.-S615 (B51-43), Rescue x Cadet (4348-89), and Rescue x Mida (4336-49). The samples ranking third were of questionable quality and do not appear to be promising. These were generally deficient in one or more properties that are considered important by the trade. These varieties and strains are Rescue x Mida (4336-139, 4336-125, and 4336-72), Rescue x Thatcher S615 (B51-16) and Rescue x Chinook (4352-96).

Table 5. Milling, baking, and chemical results on hard red spring wheats grown in the International Sawfly Yield Nursery, 1955 crop<sup>1</sup>.

Variety or Cross	C.I. No.	Test Weight	Pearl- ing Index	Protein Wheat Value	Flour Milling Yield	Flour Ash	Ab- sorp- tion Time	Mix- ing time	Sedi- men- tation time	Optimum Baking Method			Loaf Volume Corrected to 12.0 Percent Protein	
										Lb.	Pot.	Pot.	Pct.	Co.
Rescue x Mida, 4336-139		59.7	34	12.7	11.6	68.8	.41	.58	1.25	59	1.75	.56	1	697
Rescue x Chinook, 51-3625		60.9	32	13.4	12.3	72.6	.42	.59	1.75	55	1.75	.55	1	810
Rescue x Saunders, 4015-1E2	13244	59.8	35	12.9	11.9	73.3	.40	.58	1.75	55	1.75	.55	1	781
Rescue x Thatcher, B50-18		62.2	34	13.9	12.6	71.3	.39	.61	1.75	55	1.75	.55	1	795
Rescue x Mida, 4336-125		60.3	33	12.5	11.6	72.5	.40	.58	1.50	56	1.75	.56	1	788
Rescue x Thatcher, 51-2622		60.7	34	13.2	12.2	72.8	.39	.58	2.00	47	1.75	.47	1	776
Rescue x Rescue, B49-78	10003	60.1	36	12.7	11.5	70.5	.40	.60	1.75	41	1.75	.41	1	722
Thatcher		60.0	30	13.5	12.4	71.8	.39	.58	2.00	62	1.75	.41	0	807
Rescue x 1831, 51-3373		61.8	30	12.7	11.9	72.4	.40	.59	2.00	54	2.00	.54	0	807
Rescue x 1831, B51-9		60.5	32	12.8	11.9	74.1	.42	.58	1.75	47	1.75	.47	0	784
Rescue x Regent-L.506, 4016-2E		60.4	34	12.8	11.6	71.4	.39	.58	1.50	47	1.75	.47	0	754
Chinook	13220	61.3	33	13.7	13.0	72.2	.39	.59	1.75	45	1.75	.45	0	735
Rescue x Mida, 4336-72		60.0	35	13.0	11.8	73.4	.40	.58	1.50	46	1.75	.46	0	795
Rescue x Thatcher-S615, B51-16		62.1	31	12.3	12.4	70.1	.41	.59	1.75	42	1.75	.42	0	777
Rescue x Chinook, 4352-96		61.2	29	12.5	11.3	72.0	.38	.58	2.00	63	1.75	.42	0	754
Rescue x Thatcher-S615, B51-43		61.4	32	13.0	11.8	71.3	.42	.59	1.50	48	1.75	.42	0	737
Rescue x Cadet, 4348-89		60.5	30	12.9	12.1	73.6	.43	.60	1.75	58	1.75	.58	1	759
2083 x Rescue, 51-2223		61.0	32	13.6	12.5	72.9	.41	.60	1.75	59	1.75	.59	0	812
Rescue	12435	60.0	33	12.8	11.7	73.0	.44	.58	1.75	39	1.75	.58	1	750
Rescue x Chinook, 51-1697		61.1	38	14.3	13.1	71.9	.39	.59	1.50	58	1.75	.58	0	820
Rescue x Mida, 4336-49		59.9	36	12.9	11.8	73.6	.44	.58	1.75	51	1.75	.58	1	756
Average		60.7	33	13.1	12.0	72.1	.41	.58	1.71	51	1	764	84	89

<sup>1</sup>/ Composite of Dutton and Sidney, Montana stations.

The following comments or remarks are made about the quality of some of the varieties or strains which account for their ranking. These samples would have rated higher had they not been deficient in one or more of their quality properties:

Ranked 1st

Rescue x 1831 (51-3373), bread crumb color slightly down, otherwise this is a strong wheat.

Rescue x 1831 (B51-9), excellent flour yield and a strong wheat.

Chinook, better than Rescue but not as strong as Thatcher in dough-handling properties.

Ranked 2nd

Rescue x Thatcher (B-18), excellent crumb color.

Rescue x Regent L.506 (4016-2E) dough-handling properties only fair and questionable.

Rescue x Thatcher S615 (B51-43) dough-mixing time short.

Ranked 3rd

Rescue x Mida (4336-139), short dough-mixing time, low flour yield, and poor crumb color.

Rescue x Mida (4556-125), short dough-mixing time and only fair dough-handling properties. Has, however, very good bread grain.

Rescue x Mida (4336-72) and Rescue x Thatcher S615 (B51-16), dough-handling properties only fair.

Rescue x Chinook (4352-96), bread grain and crumb color inferior and loaf volume lower than expected for protein content of sample.

Special Foreign Varieties and Strains

The results for 13 varieties and strains, originally from Portugal, but grown at Moccasin, Montana, are shown in table 6. They are of interest because of their possible use as parents in crosses to obtain resistance to wheat stem sawfly. Thatcher and Rescue were included in the trials for comparison.

Table 6. Milling, baking, and chemical results on special foreign varieties and strains, 1955 crop.

Variety or Cross	C.I. No.	Test Weight	Pearling Index	Protein Value	Wheat Flour Yield	Flour Absorption As%	Mixing Time	Optimum Baking Method		Corrected to 12.0 Percent Protein	Loaf Volume Cc.	Mixogram Pattern	
								Lb.	Pct.	Pot.	Pct.		
Moccasin, Montana													
Ribeiro, 56206-11	58.5	32	17.6	15.9	73.9	.53	63	1.50	2	853	70	644 Strong	
Barbella x Santa Maria, 56222-9	57.0	30	17.4	16.6	72.0	.55	61	1.00	2	752	75	544 Weak	
Amarelo de barba preta x Ribeiro, 56219-12	56.3	31	17.4	16.5	72.9	.54	60	1.00	3	877	60q	637 Weak	
S615 Resone	57.0	33	18.0	17.7	71.6	.49	63	1.25	2	999	85	677 Strong	
Amarelo de barba preta x Ribeiro, 56219-9	57.5	29	17.4	16.4	73.5	.55	60	1.25	2	1034	80	761 Very strong	
Lobbeiro x Barbella, 56225-4	51.1	35	18.1	17.5	73.8	.55	60	1.00	2	950	85	695 Strong	
Santa Martha x Fuscente, 56229-2	56.7	27	17.8	16.7	71.5	.56	61	1.25	2	752	55u	516 Very weak	
Amarelo de barba branca x Ribeiro, 56218-1	57.0	29	17.1	16.4	72.1	.54	60	1.50	2	902	75	648 Medium	
Amarelo de barba preta x Ribeiro, 56219-7	58.0	32	17.5	16.2	69.3	.56	60	1.50	2	952	70	705 Strong	
Thatcher	10003	56.0	27	17.5	16.6	69.3	.55	63	1.75	2	1053	85	761 Very strong
Lobbeiro x Barbella, 56225-8	51.3	36	18.7	18.0	70.7	.63	61	0.75	2	740	50u	493 Very weak	
Lobbeiro x Ribeiro, 56227-1	53.1	34	18.5	17.7	71.1	.61	62	1.00	3	831	55u	563 Weak	
Average	55.8	31	17.7	16.8	71.9	.55	61.2	1.27	2	895	72	641	

The varieties and strains have been ranked numerically into groups, according to their general similarity in bread-baking quality and for purposes of discussion. This ranking is based to a large extent on a consideration of the data as a whole. Certain of the quality properties of the varieties within a group will be discussed, especially where they vary from the general average found within the group.

These wheats, considered as a whole, were high in protein and ash content, medium high in water absorption, relatively short in dough-mixing times, and required relatively high amounts of potassium bromate for maximum bread results. The trade does not look with favor on a variety or strain that has as short a dough-mixing time as many of these samples. All of the foreign wheats had shorter dough-mixing times than the comparably grown samples of Rescue or Thatcher. A number of the wheats made satisfactory bread. The milling and dough-handling properties have been deficient in some of the varieties and strains.

Rescue, Amarello de barba preta x Ribeiro (P.I. No. 56219-7), and Thatcher appear to be the best of the wheats in quality. The dough-handling, milling, and bread properties were generally satisfactory. The crumb grain of P.I. No. 56219-7 was excellent, but in crumb color it was not outstanding. Since the millers bleach their flours, this medium color may not be objectionable. Thatcher, which has been acceptable to the trade, has generally produced a crumb color not as white as many of the approved hard red spring varieties. The dough-mixing times of all three were generally satisfactory. The sedimentation values were high for these wheats and the mixogram patterns strong. All appeared to have, according to the mixogram patterns, good dough-mixing tolerance, a favorable characteristic of a satisfactory bread wheat.

Those next best were S615; Amarello de barba preta x Ribeiro, (P.I. No. 56219-9); Santa Martha x Fuscense (P.I. No. 56229-2); and Amarello de barba branca x Ribeiro, (P.I. No. 56218-1). The dough-handling properties of these were strong and elastic, but the mixing time was on the short side. All produced bread of reasonably good characteristics, but averaged a little lower in loaf volume when corrected to a 12.0 percent protein basis. Ribeiro was ranked third, had only fair milling properties, and scored medium in bread characteristics. The dough-mixing time of Ribeiro was medium and not quite as long as that of Rescue. The mixogram patterns of these varieties and strains were strong and in most cases the dough-mixing tolerance was good.

Amarello de barba preta x Ribeiro, (P.I. No. 56219-12) and Lobeiro, (P.I. No. 56227-1) were rated down (fourth) because of their short dough-mixing times and very low crumb scores. The dough-handling properties of P.I. No. 56227-1 were unsatisfactory, being sticky and weak.

Those strains ranking fifth, principally because of low loaf volume and short dough-mixing times, were Barbella x Santa Maria, (P.I. No. 56222-9) and Lobeiro x Barbella, (P.I. No. 56225-4). These milled satisfactorily and produced a good yield of flour. Strain P.I. No. 56225-4 was the poorest of the two in bread crumb color and grain. The poorest strain was P.I. No. 56225-8, Lobeiro x Barbella. The dough-handling properties were weak, mixing time was very short, and bread characteristics were poor. It was lowest of the group in loaf volume corrected to 12.0 percent protein basis. The sedimentation values were low for all of these strains, indicative of their poor bread quality. The wheats ranking 4th and 5th produced weak mixogram patterns and in all cases their dough-mixing tolerance was short and unsatisfactory. A short dough-mixing tolerance is generally found associated with wheats having short dough-mixing times.

#### Commercial Samples

As in past years, a number of commercially-grown wheat samples were obtained through the Grain Division, Agricultural Marketing Service, for comparison with the varieties and strains produced in experimental plots. Twelve such samples, representing a number of grades and types, were obtained at Great Falls, Montana and Minneapolis and Duluth, Minnesota. The samples were composited by grade from 3,129 cars of wheat grading No. 3 or better. This is the seventeenth season such samples have been tested. The results are given in table 7.

These samples generally averaged lower in protein content than the varieties and strains grown in experimental plot and nursery trials. The Minneapolis, Minnesota samples averaged 14.2 percent protein while the Duluth, Minnesota and Great Falls, Montana samples were somewhat lower, both averaging 13.9 percent. The milling characteristics were much alike for the commercial and experimental samples with the commercial samples possibly slightly higher in yield of flour. Otherwise, the baking and chemical results do not appear to be greatly different when compared with samples having approximately the same protein content.

#### Notes on Some of the New Strains of Current Interest

Each year many new strains of wheats are tested along with the leading commercial varieties for chemical composition, milling, and bread-baking quality. The data on 6 strains and 3 varieties of current interest with averages expressed as a percentage of comparable samples of Lee are shown in table 8.

#### Conley (C.I. 13157)

Conley, ND1 developed at Fargo, North Dakota, was grown at a number of the locations in the spring wheat area in 1955.

Table 7. Milling, baking, and chemical results on 12 composite commercial samples of hard red spring wheat obtained at Minneapolis, Duluth, and Great Falls, representing the 1955 crop.

Location Where Obtained	U.S. Grade	No. of Cars	Pearl- ing			Wheat Protein Value	Flour Protein	Flour Ash	Ab- so- lut- e mix- ing time	Mix- ing time	Sedi- men- tation time	Optimum Bake Loaf Volume	Grain Texture	Loaf Volume Corrected to 12.0 Percent Protein		
			Test Weight	Index	Flour Yield											
Duluth, Minn.	1HDNS	159	60.4	34	72.4	14.1	13.1	.50	64	2.25	61	1	792	75	725	
	1DNS	394	59.3	37	71.0	14.1	13.3	.48	65	2.25	61	1	812	85	733	
	1DNS	201	58.1	38	71.4	14.1	13.3	.46	64	2.00	59	1	778	75	702	
	3DNS	97	56.5	35	68.0	13.5	12.7	.49	64	2.00	54	1	732	65q	692	
	1NS	44	58.1	43	74.9	13.5	12.7	.49	63	2.25	48	1	751	75	717	
<b>Average</b>			58.5	37	71.5	13.9	13.0	.48	64	2.15	57	1	773	77	714	
Great Falls, Mont.	1HDNS	1073	61.8	31	70.8	13.4	12.6	.49	64	2.00	57	0	788	80	750	
	1DNS	275	59.5	33	68.0	14.9	14.0	.48	64	2.00	67	1	659	65q	565	
	2DNS	68	61.1	30	70.8	13.4	12.4	.50	65	2.00	58	1	881	85	853	
	<b>Average</b>			60.8	31	69.9	13.9	13.0	.49	64	2.00	61	.7	776	77	723
Minneapolis, Minn.	1HDNS	164	60.8	34	74.9	14.4	13.7	.45	63	2.25	50	2	858	70	752	
	1DNS	280	59.0	38	75.0	14.6	13.6	.48	62	2.50	62	1	873	80	770	
	2DNS	193	57.6	38	74.0	13.8	13.0	.46	62	2.50	51	1	751	70	693	
	3DNS	181	56.2	34	74.1	13.8	13.0	.48	62	2.50	54	2	810	80	748	
	<b>Average</b>			58.4	36	74.5	14.2	13.3	.47	62	2.44	54	1.5	823	75	83
<b>Total Cars</b>			3129									741				

Table 8. Comparison of the test weight per bushel, milling, baking, and chemical properties of nine varieties and strains of wheat with the variety, Lee, 1955 crop.

Variety or Gross	No. of Samples	Test Weight	Pearl-ing Index	Protein Wheat Flour	Flour Yield ASW	Ab-sorption	Mix-ing Time	Bro-mate	Loaf Volume	Crumb Color	Grain Texture	Corrected Loaf Volume
	Lb.	Pot.	Pot.	Pct.	Pct.	Mg.	Mg.	Cc.	Score	Score	Cc.	
Conley, ND 1 Lee	10	58.1 60.3	32 32	15.4 15.8	14.6 14.8	74.3 72.5	.49 .51	62 61	2.05 2.08	1.7 1.4	899 865	86 86
Percentage of Lee		96.4	100.0	97.5	98.6	102.4	96.1	101.6	98.6	121.4	103.9	100.0
Pilot <sup>2</sup> x Thatchor, ND 170 Lee	1	60.1 59.6	29 32	15.2 15.8	13.8 14.6	71.6 71.6	.43 .47	58 60	2.00 1.75	1.0 2.0	908 797	85 95
Percentage of Lee		100.8	90.6	96.2	94.5	100.0	91.5	96.7	114.3	50.0	113.9	89.5
Rescue x Thatcher, B 50-18 Lee	1	61.1 59.6	31 32	14.6 15.8	13.7 14.6	73.4 71.6	.46 .47	58 60	1.75 1.75	1.0 2.0	874 797	90 95
Percentage of Lee		102.5	96.9	92.4	93.8	102.5	97.9	96.7	100.0	50.0	109.7	94.7
R.L. 2563 x Lee, ND 3 Lee	10	59.1 60.3	29 32	15.7 15.8	15.0 14.8	72.9 72.5	.62 .51	62 61	1.88 2.08	1.9 1.4	862 865	82 86
Percentage of Lee		98.0	90.6	99.4	101.4	100.6	121.6	101.6	90.4	135.7	99.7	95.3
Lee x Mida sib., Ns 3880 227 Lee <sup>2</sup>	7	61.2 60.6	31 31	15.6 15.7	14.5 14.8	73.4 72.5	.51 .51	62 61	1.82 2.04	2.0 1.7	865 859	88 86
Percentage of Lee		101.0	100.0	99.4	98.0	101.2	100.0	101.6	89.2	117.6	100.7	102.3
Thatcher x Kenya Farm, ND 33 Lee	1	62.9 61.6	35 32	15.9 16.1	14.8 15.7	74.0 73.0	.42 .45	58 58	1.25 2.00	3.0 3.0	926 940	75 85
Percentage of Lee		102.1	109.4	98.8	94.3	101.4	93.3	100.0	62.5	100.0	98.5	88.2
Rushmore x Haynes Bluesstem, SD 1935 Lee	3	60.1 60.1	31 32	16.9 16.1	16.2 15.2	74.9 71.8	.52 .54	60 61	1.25 2.00	2.3 1.3	901 856	77 87
Percentage of Lee		100.0	96.9	105.0	106.6	104.3	96.3	98.4	62.5	176.9	105.3	88.5
Spinicota Lee	2	61.6 61.7	43 33	16.1 15.7	14.8 14.9	71.8 71.7	.48 .53	59 61	1.75 1.88	1.5 1.0	848 816	78 88
Percentage of Lee		99.8	130.3	102.5	99.3	100.1	90.6	96.7	93.1	150.0	103.9	88.6
Selkirk Lee	15	56.8 59.7	33 33	15.3 15.8	14.5 14.8	74.7 72.1	.50 .50	61 61	2.07 1.97	2.1 1.6	930 866	86 86
Percentage of Lee		95.1	100.0	96.8	98.0	103.6	100.0	100.0	105.1	131.3	107.4	100.0

Comparable milling and baking tests of 10 samples show that Conley is generally similar to Lee for most of the characteristics for which comparisons have been made. The exceptions to this are test weight per bushel 1.2 pounds lower, wheat protein content 0.4 percent lower, and yield of flour 1.8 percent higher than Lee. Conley has satisfactory dough-handling and milling properties. It has made a good showing in past years' tests and appears to be as good in quality as most of the approved hard red spring wheats.

Pilot<sup>2</sup> x Thatcher, N2170 (C.I. 12974)

One sample of N2170 showed that it was very similar to Lee in test weight per bushel, pearling index or kernel hardness, yield of flour, and bread grain and texture. It was lower in protein content and flour ash, water absorption, and crumb color of bread. N2170 required about half as much potassium bromate (an oxidizing agent) for maximum bread. It milled satisfactorily and the dough-handling properties of N2170 appeared to be good. The results of a single test indicate that N2170 is a promising bread wheat.

Rescue x Thatcher, B50-18 (C.I. 13244)

Tests made on a single sample of B50-18 show that it is like Lee for many of the properties for which it has been tested. Possible exceptions to this are wheat protein which is 1.2 percent lower, and yield of flour which was 1.8 percent higher than Lee. Strain B50-18 required about half the amount of potassium bromate for optimum bread as used for Lee. The dough-handling properties were good, being elastic and pliable, and the milling properties satisfactory.

R.L. 2563 x Lee, ND 3 (C.I. 13159)

Comparable milling and baking tests of 10 samples show that ND 3 is about the same as Lee except possibly for a few of its characteristics. ND 3 is nearly 1 pound less in test weight per bushel and is .11 percent higher in flour ash content than Lee. ND 3 has generally averaged higher in past years' tests in flour ash content than that of the approved hard red spring varieties. This high flour ash content may possibly be an inherent property of this strain. It requires a slightly higher amount of oxidizing agent such as potassium bromate for the best bread in comparison with the variety Lee. Strain ND 3 has questionable milling properties and some samples on which mixogram curves were made show a tendency towards a short dough-mixing tolerance.

Lee x Mida sib. Ns. 3880.227 (C.I. 13043)

The weighted average of 7 comparable samples shows that Ns. 3880.227 is similar to Lee in many of the characteristics for which comparisons have been made. It has milled satisfactorily and was similar in this respect to the approved hard red spring varieties.

The dough properties of Ns. 3880.227 appear to be more mellow than those of Lee. Two of the samples showed a tendency to be sticky, but the others had good handling properties. The dough-mixing patterns determined by the mixograph on a few of the samples showed that the mixing tolerance was shorter than those of the approved varieties.

Thatcher x Kenya Farmer, ND 33 (C.I. 13211)

Comparable milling and baking tests of one sample of ND 33 show that it is similar to Lee except for possibly dough-mixing time. Strain ND 33 has a considerable shorter dough-mixing time than Lee in addition to a short dough-mixing tolerance. It has satisfactory milling properties according to this single sample tested.

Rushmore x Haynes Bluestem, SD 1935 (C.I. 13162)

The weighted average of 3 comparably grown samples shows that SD 1935 was similar to Lee in test weight per bushel, pearling index or kernel hardness, flour ash, water absorption, loaf volume, and grain and texture of bread, but lower in crumb color. Strain SD 1935 averaged .8 and 1.0 percent higher, respectively, in protein content for the wheat and flour as compared to Lee. The yield of flour was 3.1 percent higher than Lee. The milling properties were satisfactory. Strain SD 1935 required about twice as much potassium bromate for optimum bread and had a considerable shorter dough-mixing time than Lee. The short dough-mixing time of SD 1935 is a serious deficiency of this strain. The dough-handling properties were only medium strong with one sample showing sticky characteristics.

Spinkcota (C.I. 12375)

Comparable milling and baking tests of two samples show that Spinkcota compares favorably with Lee in test weight per bushel, protein content of wheat and flour, flour yield, dough-mixing time, and loaf volume, crumb color, and grain and texture of bread. It requires about a third more potassium bromate for optimum bread and is slightly lower in flour ash content and water absorption than Lee. The pearling index test, a measure of the kernel hardness, indicates that Spinkcota is a softer wheat than Lee. It is similar in this respect to the soft red winter wheat varieties. It milled unsatisfactorily. The middlings were difficult to reduce to flour and the flour was soft and bolted slowly.

The dough-handling properties were weak, being soft, sticky and not as strong as the approved hard red spring varieties. This is not a promising wheat because of its questionable dough-handling and milling properties.

Selkirk (C.I. No. 13100)

Selkirk is a Canadian developed variety showing resistance to 15B stem rust at low temperatures and has been approved for distribution in Canada and the United States.

Comparable milling and baking tests of 15 samples show that Selkirk is very similar to Lee for many of the characteristics for which comparisons have been made. It has produced a higher yield of flour although nearly 1.0 pound lighter in test weight than Lee. It milled satisfactorily and made a granular flour similar to the approved varieties in this respect. Selkirk averaged slightly lower in protein content (0.5 percent in the wheat and 0.3 percent in the flour) than Lee. The dough properties of Selkirk were good, being elastic and pliable. Selkirk required about twice the amount of potassium bromate for optimum bread results as Lee. It made satisfactory bread slightly exceeding Lee in bread loaf volume. This is a good bread wheat and has many of the favorable properties found in the approved varieties.

